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Editorial.

THE COMFORT FUND: ITS OBJECTS AND AIMS.

NEITHER men nor animals, while campaigning, can do the work allotted to them well without being kept fit and in good health. Both will carry out their tasks the better by good treatment and care. The difficulty of accommodating and sheltering quickly large bodies of men, the discomfort of inclement weather, the danger to health of fighting knee or waist deep in water, the eye that must ever be on the watch for the enemy, and the arm ever ready to strike—all these things, if to be done, suffered, or kept effective, will be so much the better accomplished if means are at hand to stave off the strain of their worst features, soften their roughnesses, and aid in keeping natural keenness at concert pitch. Soldiers wounded in doing their duty will doubly appreciate little solaces and comforts.

It is well known to our profession that a fund has been started and organized by Mrs. Moore and other generous-minded ladies connected with the Veterinary profession for the benefit of the Army Veterinary Corps now on service in France.

The objects of the fund are fourfold: (1) To give the officers who command veterinary section hospitals and mobile sections a supply of warm garments and comforts from which they can draw for the benefit of their men; (2) to supply officers with small articles of warm clothing necessary in severe weather and under war conditions—young officers unaccustomed to previous campaigning especially need help in this respect; (3) to supplement and augment what clothing is available from military supply depôts (this stock is often situated at bases far down the lines of communication, and not quickly available or obtainable by men at the front); (4) to supply warm, dry garments that can immediately be given when need arises to replace what is worn out, soaked with wet, or otherwise unfit for use.

There is no doubt that these objects can better be attained and more quickly accomplished by a special fund got up for an individual corps than by a general fund collected and distributed by a large and slowly moving organization and devoted to the needs of the entire Army.

The greatness of the task entered upon in our case may be slightly understood when we state that there are attached to the Army Veterinary Corps now serving in France close on 3,000 officers, non-commissioned officers, and men. There are also a large number of horsekeepers, grooms, shoeing-smiths, &c., who have volunteered for service. The work of the Corps may be partly compehended when we set down that it acts at several base hospitals, and includes that of the operations of a dozen mobile veterinary sections which ply between the actual battlefield and the section hospital succouring and conveying the wounded animals.

Over 30,000 animals have already been treated at the hospitals and of these about 10,000 are now convalescent. Truly a noble work on behalf of creatures that have patiently and effectively performed their specified tasks in the service of their country. It is the duty of those of us who remain at home and carry on our work in safety to see that the Comfort Fund keeps strong and plentiful enough to aid and solace our brothers of the Expeditionary Force. As long as the war lasts it will be necessary to keep it going, and second contributions, or even third or fourth ones, will perhaps be required, and if needed will certainly be welcomed. Special attention may be drawn here to the fact that Christmas time is not far off, when the vacant chair will be especially noted, and the absent one be thinking of those dear to him at home. At such a time our comrades round the camp fires will be cheered and brightened by a good supply of creature comforts; they will rejoice that they are in a measure able to enjoy a remembrance from home of the festive season. Let us see that the souvenir is one of full and material benefit and tnat the kind organizers of the scheme are well supplied with the wherewithal to gladden their hearts.

Briefly, for space is limited, we would also call attention to the fact that the promoters of the fund desire to help and keep in touch with the wives and families of the men of the Corps, and at Christmas time are sending to each " wife " a Christmas hamper of gifts. Indirectly also we are benefiting the ladies

of the Victoria Veterinary Benevolent Fund, under the care of Mr. Shipley, who are giving in return for recompense a *quid pro quo* by knitting articles and working on clothes for the Army Veterinary Corps.

THE VETERINARY SURGEON WHO NEITHER READS NOR WRITES.

We have often wondered what percentage of our members take in the veterinary papers and journals. No doubt the number is greater than that of those who write articles for their pages. We hope and trust that those who receive the periodicals always read them, but we are not sure. At one time of day the theorist, the writer, or the paper veterinary surgeon were often referred to with a touch of scorn or contempt by the self-styled practical man. The former were only romancing literary folk in his eyes, and half the things they put on paper was the result of a little fact and a lot of imagination and exaggeration. The practical man learnt everything worth learning long ago. He occasionally boasted with gusto that he never read any veterinary papers, and as to contributing anything to their pages—well, that would be only letting the other fellow know as much as he knew himself. And yet the fact remains, and is well known to the discerning one, that all the progress of the profession has been inseparably bound up and associated with the efforts of the editors, writers, and intellectual forces linked to the veterinary press. At this time of day many of the self-sacrificing writers are busily engaged answering their country's call, and it is the duty of those who remain behind to see that the work they have founded and carried on shall not suffer during their absence. Let those who are left put in a little extra work for the good of the cause and send up clinicals that will gladden the editor's heart and form interesting and delectable matter for those at the front to read. Our comrades there will do their duty so much the better for having their minds drawn away for a few moments from the martial scenes around them. When they come back, doubtless they will recompense us for the slight trouble we have been put to by recording cases from the rich store of clinical experience which they are now obtaining.

Whenever we meet a man who has got behind the times in his

profession and who never rises above a certain low level, we almost invariably find that he never takes in or reads any veterinary literature. His conversation is terribly limited, and his views ancient and cobwebby. But when we encounter an advancing member of the profession we see evidence around of a plenitude of up-to-date veterinary literature, and occasionally a small but well-selected library of technical books. The conversation of this man is often interesting and generally profitable to the listener. He is awake and alert. His intellect, contrary to that of the man who neither reads nor writes, is active and keen, and this phase of mind is beneficially reflected in his everyday practice and work. The advancement of knowledge has never been furthered by those who are "larnt up." True progress in science has ever been the outcome of the labours of thoughtful men, who, while not discarding anything really good in past practice, have ever been anxious to better the results of present procedure, and have never been entirely satisfied with things as they are. The dissatisfied fellows have been the ones that have advanced, for by reading and writing they have been able to see that a standstill position was not satisfactory. The veterinary surgeon who does not read the technical journals of his calling is foolish and probably a poor practitioner. The man (chiefly in a peaceful home in the country) who looks forward with delight to getting his professional periodical weekly or monthly, and who reads it eagerly, has one other duty to perform, and that is to write something culled from his own plentiful experience for the benefit of his professional brethren. Reading makes a thoughtful man, writing an exact man, and speaking a ready man. He who records his cases adds to the sum of knowledge and helps to make his science more accurate, and no man who claims to be a good practitioner should be without his weekly or monthly veterinary periodical.

PERSONAL.

Dr. B. F. Kaupp, Commissioner of Public Health, Spartanburg, S.C., has been appointed Pathologist to the Agricultural and Mechanical College of North Carolina, where he will have special charge of investigations in the poultry department at the Government experiment station. Dr. Kaupp has recently published a most excellent little book on the diseases of birds, especially poultry, and his new appointment will give him special opportunities for following up his researches in this direction.

Original Articles.

STUDIES IN THE IMMUNITY TO TUBERCULAR DISEASE.*

II.—Autoinoculation and the Tuberculin Diagnostic Reaction.

By CHARLES C. TWORT, M.D.Aberd.
Beit Memorial Fellow.

It is often maintained that most of the specific lysin for the tubercle bacillus is fabricated by the tubercular tissue, and not usually by any of the normal organs of the body, while agglutinins and precipitins are produced by the normal cells. This is said to be the reason why it is so difficult to render a sound person sensitive to tuberculin by the previous inoculation of it. If one considers the production of lysins to bacilli other than tubercle bacilli, and if one takes into account the formation of the specific ferments to practically any foreign proteid, it would appear that the above hypothesis is very unlikely to be correct.

If it is to the presence of the lysins that the tuberculin reaction be due, then one may safely assume that the temperature produced by the inoculation of a diagnostic vaccine, in an animal suffering from such a disease as Johne's disease, relies upon the same type of anticorps; but in this last mentioned disease the histological changes are quite different from those found in tubercular disease, the only resemblance being in a certain amount of epithelioid and round-celled infiltration, which is present in both cases.

I have already shown [1] that a lysin capable of destroying Johne's bacillus may be produced by an animal on inoculating material other than acid-fast bacilli, and where there are evidently no pathological lesions in any way related to those of tubercular disease. Although these lysins are non-specific, they are sometimes very powerful; in fact as powerful as any of the specific lysins that I have been able to demonstrate.

The statement that tuberculin is toxic only for those who suffer from tubercular disease, and that a normal person cannot be rendered sensitive to it by the previous inoculation of dead

* From the Laboratories of the Brown Institution, University of London.

bacilli, must be considerably modified at the present time, for it has been shown that not only can the specific antibodies be demonstrated in the blood of animals subjected to the inoculation of a tubercle bacillus vaccine, but also that these animals will give a typical reaction. Wolff-Eisner sensitized his animals by the inoculation of crushed tubercle bacilli; Sata by the intravenous inoculation of dead tubercle bacilli. Bang and Andersen [2] quite recently have obtained results of a similar kind. These experiments are not at all surprising, for the inoculation of most foreign proteids will usually lead to a hypersensitiveness on the part of the animal for the proteid. If in an animal immunized to tubercle bacilli the temperature was not influenced by the inoculation of the same variety of bacillus at a later date, then one would be confronted with a very interesting fact; but the tubercle bacillus has shown itself to be the same as other proteids in this respect, and we should not have expected it to be otherwise. The temperature is unaffected with a very small dose, and with a still larger dose it falls (Friedberger). The tuberculin reaction is evidently produced by a medium sized dose, while an anaphylactic reaction is the result of a large dose, and thus the difference between these two reactions will in this respect only be that of the quantity of material inoculated.

For my part I have found that it is not difficult to render rabbits sensitive to tuberculin. A single intravenous inoculation of an emulsion of dead acid-fast bacilli, followed two to four weeks later by a second injection will, in a certain proportion of the animals, lead to rapid death; this occurs usually from two to twenty-four hours after the second injection is made. The dose may be a tenth to a hundredth of the normal fatal dose for an untreated animal, and it is not always necessary to use the same variety of bacillus as that with which the hypersensitive state was attained. The intravenous is the best method of inoculation for these experiments, the immunity being more difficult to obtain when inoculating by other channels. Also for the second inoculation, the intravenous is the best channel to inoculate by.

As is well known, there is usually an absence of any temperature in pseudo-tuberculous enteritis of cattle and in leprosy. The probable reason for this is to be found in the absence of any autoinoculation, and to the absence of soluble toxins.

There are other reasons for assuming that no soluble toxin is secreted by these bacilli, besides the fact that no temperature rise is noted during the natural course of the disease. In a previous paper I have shown, in collaboration with T. Craig [3], that the intravenous inoculation of a large dose of an emulsion of living acid-fast bacilli, such as the tubercle bacillus or *B. phlei*, causes a marked rise of temperature in the animal, while a similar dose of Johne's bacillus is without any appreciable effect. In the absence of a workable culture of the lepra bacilli it has, of course, been impossible to perform a parallel experiment with them; the necessary admixture of cells might materially alter the result, but I am convinced that inoculated alone the bacilli would leave the temperature unaffected. Again, as will be mentioned further on, the toxity of Johne's bacillus for guinea-pigs' leucocytes "in vitro" is less marked than that of tubercle bacilli, and it appears probable that the cells remain intact until the bacilli commence to disintegrate, a point, however, difficult to determine. Another very important factor against the presence of a soluble toxin in these "non-caseating" diseases is the enormous number of bacilli found in the lesions, while the cells, situated right in the midst of the micro-organisms, stain perfectly, and are to all appearances quite normal. Even those cells packed with bacilli take on to a certain extent the blue stain, and I do not believe that their vitality is materially impaired. Quite a different picture is given by the examination of a tubercular nodule; the cells in the centre of the tumour are so necrosed as to be unrecognizable, and but few bacilli are found, while at the margins of the nodule where the tissue is relatively sound, bacilli may be fairly abundant.

A probable explanation for the absence of any auto-inoculation is, in my opinion, that these bacilli, unlike tubercle bacilli, are not killed out in the host, or if they do die it is only as isolated members, the death of which produces no appreciable effect on the diseased animal. It must be remembered, however, that the inoculation of a specific diagnostic vaccine will give a temperature in these animals as high as that obtained in a tubercular animal on inoculating tuberculin, and the question arises as to why this does not take place during the course of the disease. Here we come to the essence of the whole problem, and, as I believe, to the fundamental difference in the course of such diseases as leprosy and tuberculosis.

In the first place, is the temperature obtained on inoculation of a diagnostic vaccine produced by the same factors as that registered clinically during the natural course of the disease? It is probable that sometimes they are the same, but at others they appear to rest upon an entirely different foundation, and what may take place is, in my opinion, somewhat as follows. The tubercle bacillus secretes a soluble toxin, and in a tubercular animal if the toxin is not got rid of fast enough, mechanically by the kidney, or by neutralization, then there is a rise of temperature accompanied usually by an increased activity on the part of the defence mechanism of the host, and a subsequent fall of the temperature, the well-being of the patient being restored. In leprosy and Johne's disease no parallel condition of affairs exists, as these bacilli secrete little or no soluble toxin. In tuberculosis the toxin, if in sufficient quantity, is probably to a certain extent detrimental to the cells, but if in small quantity it appears to excite them, and leads to destruction of the bacilli, for which we have evidence in the experiments of Achard on the stimulating effect of tuberculin for leucocytes.

The bacilli incorporated in the leucocytes become digested probably very slowly, but the product of their digestion is intensely poisonous for the leucocytes, and even if it is thrown out by the cells it must inevitably act upon the other cells in the neighbourhood. As a matter of fact, if the leucocytes are ultimately killed, it is quite immaterial whether the bacilli are destroyed inside or outside the cells, for the products of the disintegrated bacilli will eventually exercise their toxic effect on the surrounding cells, and under certain circumstances on the vital cells, when we shall have a rise of temperature and other symptoms of intoxication. In this case we are in the presence of an auto-inoculation of the second variety, but I believe this variety to be the exception.

An important feature in Johne's disease is that the pathological lesions are not enveloped by a capsule of fibrous tissue as they are in tuberculosis, but blend imperceptibly with the normal tissue, so that in this case any toxins which may be formed will be able to get away gradually and be excreted or destroyed at leisure; whereas in tubercular disease the toxins are prevented from escaping, and in the restricted diseased area the bacilli and cells reacting upon each other finally lead to destruction of both.

I may here again refer to the experiments that I have performed on the toxicity of several of the acid-fast bacilli for guinea-pigs' leucocytes *in vitro*, when, as already mentioned, those in contact with tubercle bacilli are earlier disintegrated than those in contact with Johne's bacillus, which shows that the tubercle bacilli are more toxic for them; while *B. phlei* takes up an intermediate position. Before actual disintegration takes place, one can see that the phagocytes mixed with the tubercle bacilli die earlier than the others, as this is the first tube to become contaminated with the ordinary bacteria of the air. *In vivo* the difference between the toxicity is probably more marked, for the leucocytes receive more or less normal nourishment, and it appears that in the animal body Hansen's and Johne's bacilli can live in the cells almost indefinitely without destroying their vitality.

The temperature produced on the inoculation of a diagnostic vaccine is governed by a mechanism which may sometimes be similar to that of an auto-inoculation, viz., when the product of the digestion of the bacilli is free to act upon the susceptible centres of the animal economy, but according to the theory under discussion the temperature of an auto-inoculation is usually caused by the soluble toxins.

The result of the inoculation of tuberculin into a tubercular animal is usually to produce a certain amount of hyperæmia, which may be focal or local, but, unlike most toxins causing a local inflammation, its action is delayed for several hours. The majority of other toxins that cause inflammation act very rapidly, a few minutes being sufficient in some cases, but the local reaction produced by the inoculation of tuberculin may not appear for several hours, and requires twenty-four to forty-eight hours before it is at its height. A general reaction, which may be considered really as a focal reaction, takes place at an earlier hour than a local reaction. The tuberculin reaction can thus hardly be the result of the direct action of a toxin without the intervention of any anticorps, for otherwise it should be fixed almost at once by the hypersensitive cells of a tubercular animal. Although there is no doubt that the mechanism of the reaction giving rise to an elevation of temperature and to a local or focal inflammation is not always the same, it is probable that the essence of the mechanism is in most, if not all, cases, the reaction of a specific

anticorps on its antigen. When the antigen is inoculated a certain amount of time is needed for the interaction to take place, and this will be more prolonged in a local reaction, as the absorption of the circulating anticorps will necessarily be slower than at the focus of the disease.

It is generally considered that the temperature produced by the injection of tuberculin is a result of the fermentation or lysis of the tubercle bacilli and their products which have been inoculated, the substance formed acting upon the tubercular tissue, which is dissolved, and gives rise to the tuberculin reaction. It seems simpler, however, to imagine the reaction as being caused by the toxic effect of the lysed tubercle bacilli and their products on certain vital parts of the animal economy, without bringing in the question of the cell necrosis. It is hardly necessary to consider whether the lysins act upon the whole bacilli or particles of them, or on their disintegrated, broken-down products; if the lysin commences at the bacillus it has only further to go before the final toxic product is reached. In most animals it appears that the action of the juices is slight upon the intact bacilli, no doubt owing to the fact that their coat is impermeable, for as shown by Wolff-Eisner the finely ground particles of the bacilli produce typical reactions in infinitely small quantities. The lipases would appear to be weaker than the proteases, or, put in another way, their task is harder.

Granted that the specific lysins give rise to the formation of a temperature producing toxin by their action on the tubercle bacillus particles and the broken-down protoplasmic debris of them, it is safe to assume that the diagnostic reaction produced in leprosy and Johne's disease is controlled by the same mechanism. The question now arises as to how one accounts for the presence of the specific lysins in the two last-mentioned disases, and what stimulus gives rise to their formation if there is no *intra vitam* lysis of the bacilli? and, secondly, these lysins being present, why do they not attack the micro-organisms already in the body, and so give rise to the phenomena of auto-inoculation?

In answer to the first query it may be mentioned that, although I have pointed out that the bacilli of leprosy and pseudo-tuberculous enteritis do not appear to be destroyed in the animal body, it may be safely assumed that in no single disease caused

by animal or vegetable parasites do a certain number of the invading micro-organisms escape destruction; and the disintegration of these isolated units, distributed over a large area of the body, as they are in these two diseases, would amply suffice for the stimulation of an antibody production. These are very chronic diseases, so that plenty of time is given for the body to react against the incessant stimuli to which it is subjected, but even if they were not more chronic than tuberculosis I should not consider this a serious objection. It must be remembered that in treating many other diseases, both acute and chronic, by means of vaccines, the quantity of material inoculated, in order to excite production of the anticorps, is very small compared with the number of bacilli that exist in the patient.

In my experiments on the production of agglutinins and complement-fixing antibodies I have found it easier to demonstrate them when using dead than when using living bacilli. Both lots of bacilli are distributed equally throughout the body, but whereas the dead ones all commence to be attacked by the juices of the host at once, a great number of the living ones escape altogether. The tendency would thus be for a greater quantity of anticorps to be produced against the dead than against the living bacilli, although it would be slow in both cases. The difficulty experienced by the juices to attack bacilli is evidenced by the fact that an unground emulsion is the weakest of all tuberculins, although it contains the greatest amount of protoxin. In many cases, especially in diseases due to micrococci, the highest degree of immunity is reached by using living attenuated vaccines, but the micro-organism we have to deal with here is obviously very different to an acid-fast bacillus. The highest degree of immunity appears to be reached by the inoculation of, or infection with, a micro-organism that causes a general, usually violent, reaction on the part of the body, the latter eventually gaining the upper hand. The most typical examples of this are found in the exanthematous fevers.

As to why the lysins do not react upon the micro-organisms in the animal body, we must bear in mind the fundamental difference between living and dead bacilli, and this difference is of special importance in considering diseases due to acid-fast bacilli, owing to the peculiar resistance of the last-mentioned to destruction either by specific anticorps or by ordinary chemical reagents. It

may be argued that the inoculation of a vaccine made up of living bacilli will give rise to a reaction as typical as when an ordinary vaccine is used, but there are essential points of difference between the bacilli obtained from an artificial culture, and those present in the animal body, and at the same time there is probably always plenty of dead material even in a vaccine of living bacilli.

It is generally recognized that micro-organisms having once become established in the body gradually acquire a certain immunity to the destructive agents of the host, as the latter does to them, and the victory rests on the side of that which ultimately develops the stronger immunity.

This may be easily shown by experimenting with animal parasites and chemical therapeutical reagents as demonstrated by Ehrlich. He found that by the injection of certain compounds of the heavy metals, or especially compounds containing arsenic, into animals infected with trypanosomes or treponemas, there resulted an apparent sterilization of the body; but this was found to be a fallacy, as several days later the blood was again swarming with parasites, and curiously enough the parasites of the relapse were more or less immune to the chemical reagent to which they had been previously subjected. It is for this reason that Ehrlich advocates the treatment of diseases of this kind with a single heavy dose of the reagent. In the experiments that I have performed with Levaditi on the trypanotoxin of *B. subtilis* [4], it was found that contact of trypanosomes (*T. brucei*) with the toxin for a few minutes was sufficient for the production of a resistant race; that is to say, the infection of a mouse with this mixture, or the centrifuged and washed trypanosomes from the mixture, resulted in the development of a resistant race. In the same way by submitting the trypanosomes to a few minutes' contact with a specific trypanolytic serum, and inoculating them into a mouse, the trypanosomes recovered from this mouse are resistant to the above serum. Trypanosomes seem to lend themselves especially to these experiments, for it is not in all animal parasites that the above phenomena can be so easily demonstrated. In our experiments on *Leishmania tropica* we were unable to get an immune race to any of the different toxins that we used.

How clearly practically all inoculation experiments with acid-fast bacilli show that the time elapsing before they really get a hold is considerable, and that once having acquired the essentials necessary for growth they develop with rapidity. On going from the animal body to the test tube again, there is often a similar period of incubation as it were before the bacilli get a hold, for what they acquire in the test tube they may lose in the body, and *vice versâ*. Of course there are many bacilli which will grow vigorously at once on inoculation into an animal, or when isolated from the latter on to laboratory media.

As a general conclusion from the foregoing it would appear that the temperature produced by an auto-inoculation is sometimes, but not usually, governed by the same mechanism as that which follows on the inoculation of tuberculin for diagnostic or other purposes. The soluble toxin secreted by the tubercle bacillus is the usual cause of the rise of temperature during the ordinary course of tubercular disease, but in Johne's disease and leprosy no such condition is produced, as the causative bacilli secrete no toxin capable of influencing the temperature. Death of the bacilli leads to their disintegration, and caseation of the surrounding tissues follows; in a sensitive animal this process may produce a high rise of temperature.

[1] TWORT, C. C. : Thesis, Aberdeen, February, 1914.

[2] BANG, O., und ANDERSEN, C. W.: "Einige Untersuchungen über Komplementbindende Antistoffe bei experimenteller und spontaner Tuberculose sowie bes paratuberculöser Darmentzündung," *Centralb. f. Bakt.*, 1913, Bd. 69, Heft 7.

[3] TWORT, C. C., and CRAIG, T. : "The Pathogenicity of Johne's Bacillui compared with that of Other Acid-fast Bacilli for some of the Laboratory Animals," *Centralb. f. Bakt.*, 1913, Bd. 68, Heft 5-6, p. 455.

[4] LEVADITI et TWORT, C. C.: "La trypanotoxine du Bacillus subtilis," *C. R. Soc. de Biol.*, Tome 70 et 71, 1911.

ON THE TRAINING OF VETERINARY SURGEONS FOR PUBLIC DUTIES IN CONNECTION WITH THE PREVENTION OF DISEASE WITH REFERENCE TO THE INSTITUTION OF A DIPLOMA IN VETERINARY STATE MEDICINE.

By SHERIDAN DELÉPINE, M.B., C.M., M.Sc.

Professor of Public Health and Bacteriology and Director of the Public Health Laboratory, University of Manchester.

[Reprinted from *Public Health*, September, 1914, the Journal of the Society of Medical Officers of Health.]

It has long been known to medical and veterinary pathologists that the control and prevention of infectious diseases must be based upon an exact knowledge of the etiology of these diseases, of the life history of the causal animal or vegetable parasites, and of the conditions favouring the transmission of disease and the occurrence of epidemics and of epizootics. It is now generally accepted that preventive medicine even in its most administrative aspect is based upon pathology, epidemiology, and epizootiology.

The importance of the diseases of animals that are communicable to man was early recognized by public health administrators; but while the public health service was in its infancy no adequate provision could be made for the administrative control of animal diseases. It, however, soon became obvious that the duties of medical officers of health did not allow them the time necessary to make themselves familiar with all the diseases of animals that are liable to affect man, and that sanitary inspectors from want of previous training could not be entrusted with this part of the work. It was then realized that the co-operation of the veterinary profession was not only desirable, but necessary. This appeared to us in Manchester so clearly indicated, that when in 1892 we were engaged in reorganizing the courses for the Diploma in Public Health, I suggested that provision should also be made for instruction in veterinary preventive medicine. This, in my opinion, was needed not only for the purpose of improving the means available for the prevention of human diseases, but also for the purpose of helping agriculturists in their efforts to reduce the losses due to diseases to which livestock are liable. The knowledge which had already been gained regarding the causes of many animal diseases seemed to be sufficiently advanced to justify the establishment of a public

veterinary service, somewhat on the lines of the public health service. The necessity of special training had been recognized in the report of the Departmental Committee on Pleuro-Pneumonia and Tuberculosis in 1888 (Part I, p. xiii, paragraphs 55 and 56).

There were, however, differences of opinion upon the subject, and several of the leading members of the veterinary profession whom I consulted showed themselves adverse to the institution of post-graduate courses such as were contemplated. They urged that the veterinary students who had taken a full course of instruction for the membership of the Royal College of Veterinary Surgeons and obtained the ordinary diploma of the College were competent to undertake any of the duties connected with the public services. But in the course of the subsequent ten years various sanitary authorities realized the importance of having the assistance of specially trained veterinary officers, more specially in connection with meat inspection and the control of bovine tuberculosis. The same need was felt in agricultural circles. After careful inquiries and consultations, the University of Manchester decided to institute a post-graduate course in veterinary hygiene and preventive medicine, and to grant a diploma to members of the Royal College of Veterinary Surgeons who had attended satisfactorily the course prescribed by the University, and passed an examination corresponding in scope to the examination for the Diploma in Public Health. This scheme was realized in 1902.

Considering the fact that there was not at the time outside the Board of Agriculture any regular opening for specially trained veterinary officers except in connection with the public health departments of counties and county boroughs, it was thought expedient to direct the teaching and examination towards those branches of veterinary state medicine that had a special bearing upon the prevention and control of the diseases of animals that are communicable to man. It was realized, however, that when other branches of a state veterinary service were organized certain additions would have to made to the curriculum, so as to meet special requirements. It was not thought desirable to widen the scope of the course to such an extent as to make it impossible for the students to obtain a *practical mastery* of the subjects selected for special study.

After careful inquiry it was ascertained that under the prevailing conditions it would be useless to offer a course of more than nine months' duration (that is, a whole academic year), because there would be extremely few, if any, veterinary graduates who would be willing to incur the loss of time and money which a course extending over more than one year would involve.

In the selection of subjects of study we were guided by the belief that what the average post-graduate student wanted most was to obtain a practical knowledge of (1) the scientific methods which are constantly needed in the investigation of the causes and phenomena of disease; (2) the practical application of the knowledge gained by these methods to the administrative control of disease.

With regard to students showing special aptitude for research, and desiring to do some special work, it was thought that the best way to meet their case was to offer them opportunities to carry out suitable investigations in the laboratory under the supervision of the staff. But the main object was to give the men attending the University post-graduate course a sound, practical knowledge of scientific and administrative methods which had proved of value or might become useful in the investigation and prevention of disease. This appeared to be the best way to prepare the men for the efficient discharge of the important and responsible duties that might be entrusted to them by public authorities.

In order to carry out this scheme, it was found necessary that post-graduate students should obtain their instruction not only from pathologists, bacteriologists, zoologists, chemists, and other laboratory workers, but also from veterinary officials engaged in administrative work in connection with the inspection of farms, markets, abattoirs, &c. The subjects which appeared most suitable for teaching of a practical character in the laboratory were comparative pathology, with special reference to the causes and mode of spread of disease, the life history of the most important animal and vegetable parasites, the influence of various factors upon the occurrence and distribution of disease, and other subjects generally included in epidemiology or epizootiology. It was also thought desirable to give a place in the curriculum to practical chemistry, more specially with reference to the analysis of water, air, soil, and various dairy produce and foodstuffs, not

with the object of making the students competent analytical chemists, but rather for the purpose of making them familiar with the meaning of analytical results, and also in order to complete a part of their scientific training, which is often neglected at an early stage.

The scope of the instruction which it has been found possible to impart with some success during the last twelve years is indicated in a general way in the regulations of the University of Manchester as regards the subjects of the examination for the Diploma in Veterinary State Medicine. (The examination lasts four days, three of which are devoted to practical work and oral examinations.)

(1) Practical chemistry, with special reference to veterinary hygiene.

(*a*) Methods of qualitative and quantitative analysis, with special reference to the examination of air, water, soil, and foods.

(*b*) The principles of warming and ventilation.

(*c*) Meteorological instruments and their use.

(2) Practical pathology, parasitology, and microscopy.

(*a*) Practical bacteriology, including bacteriological analysis of air, water, foods, and soils. Disinfection and sterilization. Isolation and identification of pathogenic bacteria.

(*b*) Recognition of animal parasites. Life history of some of the most important animal parasites.

(*c*) Morbid anatomy of lesions associated with parasitic diseases (characters of diseased meat).

(*d*) Microscopical impurities of foods, air, and water.

(3) Comparative pathology of domesticated animals.

Pathology of epizootic diseases and of diseases due to unwholesome food, air, water. Influence of housing, climate, season, soil. Geographical distribution of diseases. Artificial and natural immunity. Effects of heredity on liability to disease.

(4) Veterinary hygiene.

Construction of stables, byres, pigsties, kennels, &c. Hospitals, abattoirs. Methods of ventilation, drainage, disposal of refuse. Foods. Water supply. Methods of transport.

(5) Sanitary law and administration.

Control of contagious diseases under the provisions of the Contagious Diseases of Animals Act. Statutes and by-laws.

(6) Inspection of meat, dairies, cowsheds, farms, &c. Sanitary reporting.

In the conduct of the examination the University has had the assistance of the highest authorities in the kingdom, viz., of Sir John M'Fadyean and Sir Stewart Stockman.

That the institution of a post-graduate course in veterinary state medicine has met a want is shown by the fact that a number of men of high standing have taken advantage of the opportunities offered by the University, but the most convincing proof of the need which veterinary surgeons wishing to enter public service have of special post-graduate instruction has been given by the Royal College of Veterinary Surgeons, who have quite recently instituted a Diploma in Veterinary State Medicine* on lines similar to those which have been described above.

REPORT ON THE RESULTS OBTAINED BY THE SPECIAL COMMITTEE FOR INVESTIGATION OF INFECTIOUS ANÆMIA OF HORSE.

(Horse Administration Bureau, Tokyo, 1914).

(1) Introduction.

(*a*) *Organization of the Committee for the Investigation of Infectious Anæmia of Horse.*

The Special Committee for the Investigation of Infectious Anæmia of Horse was organized by the Government in July, 1909, and it has been put under the control of the Bureau of Horse Administration. The reason for establishing the committee is as follows:—

Lately outbreaks of a peculiar horse disease were noticed at several important breeding districts in Hokkaido and the north-eastern part of Hondo (main island of Japan). Several hundreds have already been lost both in the Remount Depôt of Military Horses and among horse owners. This disease, which causes pernicious anæmia, is mainly confined to the pasturing districts. Since almost all the horses that contract the disease are sure to die, it has created considerable alarm among horse breeders in Japan. Despite the fact that its etiology had been assiduously investigated at several governmental institutions, satisfactory

* The term Veterinary State Medicine was adopted by the University of Manchester to indicate the fact that the object which the University had in view was the preparation of men for state and other public services in which a knowledge of veterinary medicine was of importance.

results had not been obtained. Moreover, in the affected regions no means of checking the disease had ever been attempted because of the entire lack of knowledge of its causative factors. Judging from the invasion and the progress of symptoms we cannot deny that the disease is of an infectious nature. Should its etiology and preventive means not be made clear soon, the disease would cause an unrestorable loss upon the horses of the whole empire of Japan.

(*b*) *Object and Methods of Investigations.*

The object of the Committee is to investigate the nature of the disease and to find out the most practical methods of treatment and prevention for immediate need, leaving detailed scientific research on the disease for the future.

The investigations have been carried on along the following three lines, and the commissioners have been divided into three groups accordingly:—

(1) Careful investigations of the conditions of initial outbreak and spread of the disease, clinical examination and treatments, methods of prevention, &c.

(2) Protistologic, pathologic, and chemical study of the disease.

(3) Comparison of the disease with similar ones occurring among the horses of foreign countries.

At the request of the commissioners ten experiment stations were founded at different times during the past six years.

(*c*) *Results of Investigations.*

As the chief results accomplished by the Committee the following five items may be mentioned:—

(1) In September, 1909, "Rules for the Remedy of Infectious Anæmia of Horse" and "Explanation of Symptoms" were drawn up by the Committee and submitted to the Government as a draft for the "Investigation for the Prevention of Infectious Anæmia of Horse" to be issued by the latter.

(2) In May, 1911, a draft for the Laws for the Prevention of Infectious Anæmia of Horse and various rules therewith connected were discussed by the Committee and resolutions were made.

(3) In December, 1911, the Results of Investigation obtained by the Special Committee for Infectious Anæmia of Horse were discussed by the Committee and were made public.

(4) In April, 1913, a project of Law for the Prevention of Infectious Anæmia and rules therewith connected were again discussed and amended (*vide* of the Preventive Methods on p. 17.)

(5) In September, 1913, the Report upon the results obtained by the Special Committee for Investigation of Infectious Anæmia of Horse was discussed, revised and supplemented by the Committee.

The investigation of the Committee lasted for four years and ten months, extending from July, 1909, to March, 1914. Animals used for experiments by the Committee numbered over a thousand: 980 horses, 1 donkey, 7 calves, 5 goats, 6 sheep, 7 pigs and a few other small animals. The entire expenditure amounted to over 80,000 yen.

(2) Short History of the Appearances and Spread of Infectious Anæmia among Horses.

It is certain that in olden times infectious anæmia did not exist among Japanese horses, but we have at present no way of ascertaining when and how outbreak of the disease took place for the first time in this country. Usually the appearance of the disease becomes known to the public at the time when it has already been spreading for several years to a considerable area, out-of-the-way pasturing districts among mountains being first invaded, where ignorant people totally lack the knowledge of preventive methods.

It may be concluded that the disease is confined to a part of Hokkaido and several districts of the north-eastern part of Hondo, and does not invade the southern part of Japan, because the pasturing is restricted in the north, this being one of the necessary conditions for the transmission of the disease.

The exact number of yearly losses is also unknown for the same reason as mentioned above. But inferring from what has been learned from frequent visits of the commissioners to the infected regions, losses are not heavy at any place in the first year of outbreak. From the second year on the patients gradually increase in number. Tremendous losses follow for some years. A great majority of the horses succumb to the disease. Then slowly it is abated.

Any district once affected seems to retain the disease for a

considerable number of years. An instance in the province of Hidaka will illustrate this. Five or six years after the initial outbreak in a small village, Horoizumi, Urakawa Branch of Hokkaido-cho (the entire province of Hidaka is under the control of this office), they began to keep statistics of horses dying of the disease.

1900	27 horses	1905	7 horses.
1901	41 ,,	1906	18 ,,
1902	30 ,,	1907	5 ,,
1903	10 ,,	1908	2 ,,
1904	14 ,,	1909	2 ,,

From this table it will be seen that even more than ten years after the initial outbreak cases are still found.

The following will show that if proper preventive methods be applied, the damage occasioned by the disease will be considerably reduced, even if it is not possible to check it out of the district at once. In July, 1911, it was reported that many horses were affected by the disease in a part of Sekimoto village, Taga Country, Ibaraki Prefecture, and our careful investigation revealed that the virus was imported from a neighbouring pasture of the prefecture of Fukushima, where a great many horses had already succumbed to it. We soon came to the conclusion that this was an excellent place to carry out most profitably the experiments of prevention. As the first step all the horses were carefully examined. Those which showed even the slightest sign of the symptoms characteristic of the disease were bought and killed. As the result of this 107 horses of the village were reduced to 45, 24 having died of the disease and 38 having been killed. This method proved to be very effective, since not a single horse of those remaining succumbed to the disease, though some have had a weak form of it. This seems to give an important side-light that, though one infected horse is able to affect the whole herd, yet those animals which have had a slight form of the disease seem to acquire immunity and do not show any further symptoms at all.

We regret that we do not have exact statistics of yearly losses in various localities. However, the following numbers show the totals of cases reported by local governors since the establishment of the Committee:—

1910	341	horses
1911	376	,,
1912	359	,,
1913	263	,,

It may be added that the above cases are those which were reported to the local governors by the horse owners and veterinary practitioners. Besides these, there must have been cases which remained unreported due either to the negligence on the part of horse owners or to the lack of regulations for reporting. In any event we can estimate without grave mistake the whole number of patients in Japan to be between 400 and 500. Lately the cases are decreasing in number, due partly to the fact that the disease has already spread as extensively as it possibly can and partly to the immunity acquired by the horses of affected districts.

The horses belonging to the remount depôt of military horses have contracted the disease, and a considerable number has already been lost. When the initial outbreak took place we do not know, but since 1905 a great many horses have died from deaths attributed to the diseases of the spinal cord, of the heart, anæmia, &c., in the pastures of the branches of the remount depôt at Hagino, Yamagata Prefecture, Kajiyazawa, Miyagi Prefecture, Rokuhara, Iwate Prefecture. In 1907 it was discovered that all the losses had been due to infectious pernicious anæmia. Ever since that date the disease has invaded all the pastures of the branches of the remount depôt and the maximum losses came in 1910; the number of the horses that died and were killed taken together reaches over 500. Since then the number of patients has decreased as the result of strictly carrying out the preventive measures. As the virus is usually introduced into the pastures of the branches of the remount depôt through two-year horses, which look healthy when bought, and afterwards prove to have been infected when pastured in the summer, our constant effort to annihilate the disease completely has not as yet been rewarded. And even now fairly heavy losses take place every year.

(3) Pathogenesis.

(*a*) *Nature of the Disease.*

The great spread of infectious anæmia in pastures is due to the transmission of the virus from one individual to another by

insects. Very seldom are horses infected through the alimentary canal in stables.

Unless the disease is of a subacute nature and death soon ensues, it is usually characterized by its insidious and chronic course. The first few months after infection frequent intermittent febrile attacks occur. But when the illness is alleviated a little, patients as a rule acquire the power of resistance against the virus, and febrile attacks decrease in number until they return to normal. It need hardly be mentioned that the virus is retained in the body for a considerable length of time.

The chief pathologic change of the disease consists in a marked decrease of the red blood corpuscles. Also more or less noticeable lesions are found in the heart, liver, spleen, kidneys, lymph glands, bone marrow, &c. Mortality is between 30 per cent. and 70 per cent., according to the conditions of the disease, climate, care of patients, &c.

Blood examinations of the affected horses reveal that three to four millions of red corpuscles are present in 1 c.mm., and in advanced cases less than one million in so much blood; that is, less than one-seventh of the number of red corpuscles is found in normal blood (six to seven millions). If the red corpuscles of the patient's blood be precipitated to the bottom of a graduate, its coagulation being prevented, the corpuscular layer measures less than one-tenth the whole volume, while in normal blood it is more than four-tenths.

(*b*) *Etiology.*

In order to detect the causative agent of the disease the blood and viscera of patients were subjected to all possible microscopical and culture methods with negative results. It was found that the virus passes through Berkefeld's and Chamberland's filter. It should be remarked that the apparatus had been tested with *Bacillus prodigiosus* beforehand and had been proved really bacteria-proof. From this we can infer that the disease is caused by one of the ultramicroscopic organisms.

That the virus is present in the blood and various viscera was demonstrated by the following experiments. An animal of quite advanced case was killed and ten different organs were taken out of its cadaver (blood, spleen, liver, kidneys, spinal cord, lymph glands, salivary glands, muscles, lungs and bone marrow).

Each organ was injected into two healthy individuals, thus using twenty experimental horses altogether (experimental horses-extra series, Nos. 9-18, 21-30). Every one of them became affected in the course of from eleven to fifteen days. Urine and milk of a patient were separately injected into healthy individuals (experimental horses-extra series, Nos. 1-3). They also showed typical symptoms of the disease. The conclusion can be drawn from the above experiment that the virus is excreted in urine and milk. We could not, however, detect it in the fæces and sweat of sick horses.

If blood be drawn from a patient during a febrile attack and even a small quantity of it, say 5 c.c., be injected into a healthy horse, the latter thus becomes affected. A horse receiving intravenously 0·5 c.c. of serum diluted with saline solution showed characteristic symptoms of the disease after an incubation of seventeen days.

According to the results obtained by the experiments performed upon sixteen horses, the first febrile attack came from nine to twenty-nine days after a subcutaneous inoculation of 20 c.c. of the patient's blood. In one instance, in which a horse received 100 c.c. of the patient's blood subcutaneously, the latent period was only three days.

Healthy horses (experimental horses, Nos. 510-630) receiving patient's blood with 2·5 per cent. to 5 per cent. of sodium taurocholate remained unaffected. This seems to indicate that the causative agent is not of bacterial, but of protozoan, nature.

The Retention of the Virus for a Long Time in the Blood of Convalescent Horses.

Not only can it be demonstrated that the virus of the disease is in the blood at intervals between febrile attacks, but it was also proved that it is retained in the blood for a long time even after recovery, and causes future outbreaks of the malady. In order to determine accurately the length of the time of retention of the virus in clinically recovered horses, we performed the following experiments:—

Blood was drawn from

2	horses	3	months	after	recovery
2	,,	6	,,	,,	,,
3	,,	8	,,	,,	,,

2 horses	9	months	after	recovery.
1 horse	11	,,	,,	,,
4 horses	12	,,	,,	,,
3 ,,	13	,,	,,	,,
2 ,,	14	,,	,,	,,
1 horse	16	,,	,,	,,
1 ,,	22	,,	,,	,,

and was injected subcutaneously into twenty-one healthy horses. All became affected except two; one was of the number which received the serum taken three months after recovery, and the other of those that received the serum taken thirteen months after recovery. Since the virus was not detected in the blood of these two experimental horses they were killed, and various viscera (liver, spleen, lungs, kidneys, lymph glands, brain, muscles, bone marrow, salivary glands) were taken out of the cadavers. They were again injected into healthy animals. All of them manifested afterwards characteristic symptoms of the disease. This undoubtedly shows that the virus was present in the viscera, though it was not demonstrated in the blood.

Three horses, which had completely recovered from heavy attack of the disease and have been subjected to ordinary work in a regiment, were selected for experiments. Their blood was drawn from time to time for three years and was injected into healthy animals. By the blood taken from a horse three years after recovery, two out of three became affected within the usual period of incubation. In another experiment on two horses, which received the blood drawn four years after recovery, we found that one of them became ill after a latent period of sixty-five days. In still another experiment on two horses, which received the blood taken five years after recovery, the result was negative.

These experiments clearly show that the virus gradually diminishes its power and finally vanishes.

Relation between Patients and their Offspring.

Though the infection of the disease in stable is extremely rare, the relation between patients and their offspring must be of a peculiar nature. One can readily notice in affected districts that young horses rarely contract the disease. The following experiments were undertaken to clear up this point: —

(1) Blood was drawn from four foals brought forth by affected mothers, and was inoculated into four horses (experimental horses Nos. 443, 445, 446, 464). One was affected, two showed doubtful symptoms, and one gave negative result.

(2) Milk of patients (30-100 c.c.) was injected into three horses (experimental horses Nos. 563, 443, 566). All became affected after latent periods of twenty-four, forty-six, and forty-two days respectively.

(3) Milk of patients was given every morning internally to healthy stallions and colts, but no positive result was obtained.

(4) Blood was drawn from a young horse of an affected mare, before it began sucking, and was injected intravenously into two healthy horses (experimental horses Nos. 554 and 615). Two showed typical symptoms of the malady.

(5) A foal from an affected mare was stopped sucking at the age of a little over four months, and was kept outside the stable. It became ill, and died with typical symptoms of infectious anæmia.

From the above experiments we may be able to conclude that the virus is present in the milk of a patient, and that the virus also penetrates into the fœtus through the placenta. And the transmission of the disease to the young seems to be accomplished more frequently during its intrauterine life than through sucking virus-containing milk.

Experiments on various Animals.

In case the donkey contracts the disease, it usually shows acute symptoms and dies rather suddenly. As to animals outside the equine family the pig is most susceptible; young goats and sheep also show slight febrile conditions; calves, rats, guinea-pigs, rabbits and dogs have no susceptibility at all towards the disease.

(4) Modes of Infection.

In investigating the appearance and spread of infectious anæmia among horses in Japan, it has been learned that very few cases develop in the stable, while in the pasture it usually spreads with an astonishing rapidity, a great majority, or even the entire herd, succumbing to it. To take a concrete example. At the branch remount depôt, where horses are pastured during the summer, many cases are met with, while in the regiments where horses are quartered in stables the disease does not spread out of

them, though a few sporadic cases may occur among reserve horses. No cases have as yet been recorded in which outbreak took place in the districts where horses are usually kept in stables, the spread of the disease having been restricted to pasturing districts. What seem to be sporadic cases encountered in breeding or working districts are in reality those introduced from other parts of the country.

From what has been mentioned above, it can be conjectured that there must be conditions peculiar to the pasture which favour infection of the disease. Consequently detailed investigations have been carried out along the following four lines, namely: (1) Infectivity of the patients' excretion; (2) infection through the alimentary canal; (3) infection in the stable; and (4) infection in natural environment. Towards the solution of the above problems the Committee has devoted most of its energy and time extending over six whole years. The number of the horses used for these experiments reached about 150.

(*a*) *Infectivity of the Patients' Excretion.*

(1) *Urine.*—Two horses received subcutaneously 100 c.c. of the patient's urine, and one other horse 150 c.c. After latent periods of eleven to seventeen days all three became affected. Three horses received subcutaneously 15 c.c. of a patient's urine. They showed typical symptoms after fifteen to twenty-five days (experimental horses-extra series, Nos. 2, 3, 31).

(2) *Fæces.*—Fæces of a patient were mixed with saline solution and were treated with Berkefeld's filter. The filtrate was injected into a horse without any effect whatever. Hence we may be able to conclude that the virus passes out in urine, but not in fæces. This result agrees well with that obtained by feeding experiments to be described in the next section.

(*b*) *Infection through the Alimentary Canal.*

100-200 c.c. of the patient's urine were given every day internally to two horses (experimental horses-extra series, Nos. 34, 47). All became affected in a little over thirty days. One horse (experimental horse No. 479), receiving 100 c.c. twice a day (once in the morning and the other time in the evening) for over 120 days, was not infected at all.

100 c.c. of the patient's blood were given to four horses (experimental horses-extra series, Nos. 9, 10, 43, 44) mixed with

the feed every day or every other day. Two out of the four became ill after about fifty days, and the remaining escaped affection.

Fæces of a patient were given mixed with the feed every day to five horses. The result was negative.

From the above experiments conclusion can be reached that the entrance of the virus into a healthy individual through its alimentary canal can actually take place; but, since infection by this mode is accomplished only by protracted application of an unnatural method, contact infection in nature, if any, must be a very slow and limited process.

(*c*) *Infection in the Stable.*

Patients and healthy individuals were quartered in the same stable to see if infection takes place among them. Of eleven horses used for the experiment only two became affected. The experiments were performed purposely during the winter, when the development of insects is suspended.

(1) For six months, from August, 1910, to January, 1911, three healthy animals (experimental horses Nos. 6-8) were kept with the patients at Hagino Branch Remount Depôt. One horse became affected after sixty-four days, and in the other two the result was ambiguous.

(2) For five months, from December, 1910, to April, 1911, three healthy horses (experimental horses Nos. 90, 108, 487) were kept with a patient at the experiment station of the Agricultural College, Tokyo Imperial University. One of them was infected, and the other two showed negative result.

(3) For about ten months, from May, 1911, to February, 1912, two horses (experimental horses Nos. 105, 115) were kept with a patient at the Institute for Infectious Diseases. Neither of them became ill.

From the above experiments we can reach the conclusion that infection very rarely occurs in the stable. This result agrees with that of another experiment carried on in a stable from which the access of insects was prevented by means of wire netting (*vide* the next section).

(*d*) *Infection in Natural Environment.*

Several experiments were performed in the open air to determine the actual course of transmission of the disease. The following are the main problems to be solved:—

(1) Does the virus winter in pasture?

(2) How does infection take place when healthy animals are kept with patients or virus-carriers in the same pasture?

(3) How is the virus transmitted from one horse to another in pasture?

(4) How is the disease related to blood-sucking insects?

In order to solve the above questions pasturing experiments were carried on during four summers (1909-1913). Their progress and results therefrom are as follows:—

Wire-netting Stable. Open-air experiment station at the Izumi pasture of the Shirakawa Branch of Remount Depôt at an elevation of about 3,000 ft.

(1) It had long been known that terrible infection from the disease took place at pasture, but we did not have any information regarding the length of time of the retention of the virus there. To see whether or no the virus in our case persists for a long time, as in Texas fever, five healthy horses were kept over a month in the autumn of 1909 in the Higashima pasture belonging to Hagino branch of the remount depôt of the military horses, where many patients had been produced year after year until 1908. The result was negative. But from this we cannot deny the presence of the virus in the field; this negative result may be due to the absence of the transmitter of the disease; for the

experiment was performed rather late in the season. To exclude the above possibility the same experiment was repeated in 1910 at the Masugata section of Izumi pasture belonging to the Shirakawa branch remount depôt, where patients had been exceptionally abundant in 1909. Should the virus winter in some form or other, any healthy horses in the section would certainly become affected. Six horses good in flesh and spirits were pastured for 101 days in the summer (from July 5 to October 31), the usual season of prevalence of the disease. All subjects kept up their health, in spite of the fact that during the experiment insects were thriving and the horses were not well nourished owing to weak growth of grass there.

These experiments clearly show that the virus of the disease is not retained for a long time in pasture as is the germ of anthrax. Any pasture can, therefore, be considered perfectly healthy if the patients were produced in the preceding years.

(2) It is a well-known fact that infection from the disease usually takes place in the pasture, but not in the stable. However, to determine how dangerous the patients or the virus-carriers are in the case of the mixed pasturing, we must have recourse to pasturing experiments. They were, therefore, performed twice, once in 1910 and again in 1912, at Izumi pasture. In 1910, from July 5 to October 31 (119 days), four healthy horses (experimental horses Nos. 61, 62, 63, 64) were allowed to live with the seven virus-carriers in a special section entirely separated from other herds. All of the subjects contracted the disease. Two years later a similar experiment was tried. For six months, from May 1 to October 31, 1912, four healthy horses (experimental horses Nos. 471, 486, 492, 493) were kept with two patients and two virus-carriers. All the horses became affected; the earliest case appeared in sixteen days. In comparing the result of these experiments with that of the foregoing (pasturing of healthy horses alone) the difference is very pronounced, and we can hardly escape from the conclusion that the terrible spread of the disease was due to the intermingling of healthy horses with the patients or virus-carriers in the pasture.

(3) How is the virus transmitted from the patients or virus-carriers to healthy animals? The virus is excreted in urine, it is true, but in order to induce the disease artificially a large quantity of the urine (repetition of the internal administration of more than

100 c.c. each time) must be given. Moreover, a large portion of the patient's urine would soon find its way into the ground after excreted, and what is left on the surface would be disinfected by the direct sunlight. Urine, therefore, can safely be excluded from the causative factors of the transmission of the disease in the pasture.

To consider the difference between the pasture and the stable, excretion products are more abundant in the latter than in the former. But the proportion of cases appearing is just the reverse, as was described before. The cause of the infection must, therefore, be sought in a different direction. The problem of the transmission of the virus by the blood-sucking insects naturally suggests itself. In foreign countries experiments have been tried to test the theory of insect transmission in the allied diseases (infectious anæmia of Europe, swamp fever in America), but no positive results have as yet been obtained. As a matter of fact, some investigators disbelieve in such a theory. At present the relationships between the disease and insects, therefore, are obscure. To clear up the question, we performed on a large scale entomological experiments at a section of Izumi pasture where insects abound. A wire-netting stable and wooden enclosures were constructed (see illustration). The wire-netting stable is a gigantic cage, so to speak, 16·3 m. long, 7·2 m. wide, on one side (north side) of which is a wooden wall, three other sides and the roof being made of fine wire netting to prevent the access of the insects to the horses within. The wooden enclosure is a rectangular-fenced area without a roof, 18·1 m. long and 10·9 m. wide. Two or three enclosures were constructed with an interval of about 12·7 m. between them. These were to separate herds. In the above wire-netting stable both healthy horses and the patients were kept together, and were watched to see how the infection takes place without interference of insects.

Experiment 1.—In 1911 one patient and four healthy horses (experimental horses Nos. 397, 395, 399, 340) were let in. Two (experimental horses Nos. 395, 397) became affected after a protracted latent period. The other two remained healthy.

Experiment 2.—In 1912 six very advanced cases and two healthy horses (experimental horses Nos. 475, 472) were kept together for four months. One (experimental horse No. 475) became ill after six months, and the other remained perfectly healthy.

From these experiments it may be concluded that the disease can be propagated among the horses simply by living together without the aid of insects, provided the place be highly infested. But this mode of infection is very weak, and cannot be compared with what takes place in mixed pasturing in the open air.

The next experiment consists in keeping the patients and the healthy horses in separate enclosures during the season of the development of insects. Thus intercourse between the two sorts of animals was cut off, free access of insects to the animals being allowed.

Experiment 1.—In 1911, from July 5 to October 13, nine patients were kept in one enclosure to make it highly infested, while in one of the neighbouring healthy enclosures four healthy animals (experimental horses Nos. 341, 342, 404, 405) were received. The latter showed signs of being affected in one month, and finally every one of them manifested symptoms of advanced stage of the disease.

Experiment 2.—In 1912 five patients were put into an enclosure; two of them died in a short time; one fell into a heavy form of the disease; two did not show marked symptoms though strongly emaciated. In the enclosure A two healthy horses (experimental horses Nos. 466, 483) were kept throughout the whole length of the pasturing season. In the enclosure B four healthy horses, two at a time, were put in. Three of them (experimental horses Nos. 477, 491, 559) manifested typical symptoms; one (experimental horse No. 560) remained unaffected. The reason why in the Experiment 2 the proportion of the infection was smaller than in the Experiment 1 may be sought in the fact that in the former the virus was rather rare in the patients' enclosure.

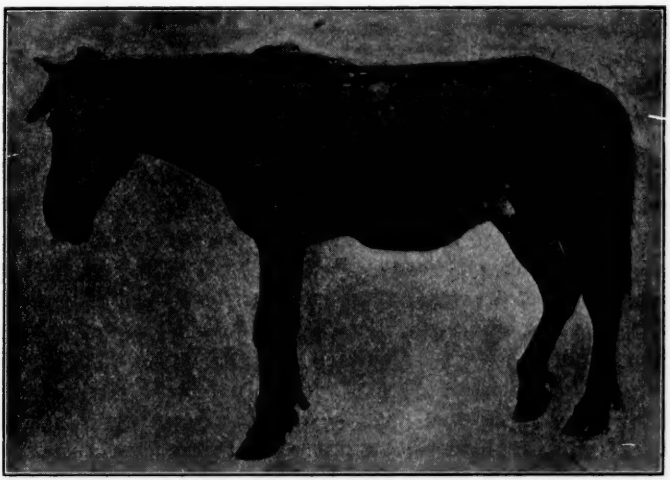
Experiment 3.—In 1913 the above experiment was repeated extending from May 1 to October 31. Nine patients were received in one enclosure. Two healthy horses (experimental horses Nos. 552, 564) were kept in the enclosure A during the experiment, and in the enclosure B four horses (experimental horses Nos. 572, 573, 565, 634) were let in, two at a time. The process of the infection was carefully watched. The result was very striking, all the healthy animals contracting the disease.

The above three experiments clearly demonstrate that the disease can be transmitted without intercourse between the

healthy and sick horses, when free access of insects is not prevented, and that under such circumstances the infection goes on in a degree as fierce as in the mixed pasturing. From this the conclusion may be drawn that the transmission of the disease under consideration is accomplished only through the agency of insects that are capable of flying.

(4) The insects and their allies which occur in pastures and attack animals are as follows: ticks, bot-flies, sand-flies, mosquitoes, horse-flies, &c.

(*a*) Ticks (*Ixodidæ*).—Ticks have no power of flying, and,



An advanced experimental case of infectious anæmia (Experimental Horse No. 534—gelding, 18 years old, sheared) photographed ten days prior to death. Notice the patient's great emaciation, depressed head and ears, lack of spirits, and œdema of the belly, the prepuce and the extremities.

moreover, if these parasites on the patients be transferred to the healthy horses, the latter do not become sick at all.

(*b*) Bot-flies (*Gastrophilus equi*).—These do not belong to the blood-sucking insects, but since its larvæ are found in the horse's stomach, the virus may thus be taken from the sick horses and transmitted to the healthy. To exclude the possibility several larvæ were taken out of the stomach of a horse dying of this disease, crushed in a mortar, filtered, and injected into healthy animals, but the result was negative. Furthermore, in 1912

bot-flies were exterminated from all the horses before pasturing, and it was noticed that the removal of the insect did not influence the spread of the disease in that particular summer.

(*c*) Mosquitoes (*Culecidæ*).—They can safely be excluded from our present problem; for they are found only in the stable and not in the pasture.

(*d*) Sand-flies (*Simulium*).—This insect is very abundant in the pasture. The power of sucking blood is very strong; horses are, therefore, greatly annoyed by the sand-fly. This insect appears very early and stays until late autumn. Therefore there is a time when this insect monopolizes the pasture, all other insects disappearing. Choosing such a time of the year healthy horses and the patients were kept near each other in the same pasture, preventing, however, the intermingling of these two groups of animals. None of the healthy horses contracted the disease. In spite of the fact that the sand-flies attacked both the healthy and the sick animals for nearly a month, the disease was not transmitted. Hence we have reached the conclusion that the sand-flies have nothing to do with the process of infection.

(*e*) Stable-flies (*Stomoxis calcitrans*).—This is also a blood-sucking insect occurring as abundant and living as long as the sand-flies. It abounds in the stables of the plains. We, therefore, tried an experiment as early as 1908, letting the fly, which had sucked much blood from a patient, bite healthy horses; but the result was negative. During the season of the stable-fly the patients and the healthy horses were kept in two enclosures near each other. The result here was also negative. Next, many flies were kept in the wire-netting stable with the healthy and affected horses and allowed to bite the animals freely. Excepting a case of doubtful infection (experimental horse No. 472) among the healthy horses, the transmission of the disease was not so marked as in the mixed pasturing and in wooden enclosures. Hence the stable-flies cannot be taken as the true transmitters of the disease.

(*f*) Horse-flies (*Tabanidæ*).—These are most abundant in the pastures and attack horses violently. In the stables they are scarce. It must especially be mentioned that the spread of the disease coincides in time with the appearance of this insect. Therefore at the outset of the experiments we caught many horse-flies and tried to let them bite healthy horses, but we soon dis-

covered it extremely difficult to keep them alive for any length of time. Moreover, we could not force them to suck blood out of the patients, though all the possible artificial means were tried. Not having been able to overcome these difficulties, we could not, to our regret, demonstrate experimentally that the horse-fly is an actual transmitter of the disease. But deducing from the fact that the infection takes place both in the mixed pasturing and in the wood enclosures at the period of the appearance of horse-flies, and that other blood-sucking insects are not likely to be the virus-transmitters, as was already described, we cannot escape from the conclusion that the infection of the disease is accomplished through the agency of the horse-fly.

Several species of horse-fly occur in the pasture where the foregoing experiments were performed. The time of appearance differs in different species.

Chrysopus japonicus WIED: The first part of May—the first part of June.

Hæmatopota tristis BIGOT: Latter part of May—the first part of July, again in the first part of September.

Several species of *Tabanus* (*T. chrysurus* LOEW, *T. trigonus* COQ., *T. trigeminus* COQ., *T. luridus* FALL., *T. rufidens* BIG., &c.): July, almost simultaneously, very abundant in August, disappear in October.

Inferring from the fact that in the pasturing experiments already mentioned the disease spreads both in May and June, when *Chrysopus japonicus* and *Hæmatopota tristis* appear, and in July and August, when several species of *Tabanus* develop, we can hardly avoid the conclusion that those horse-flies are the real transmitters of the infectious anæmia among horses in Japan.

(5) SYMPTOMATOLOGY.

General Symptoms.—The prominent features of the disease are irregular recurrences of fevers and progressive anæmia. At first the febrile attack comes suddenly and it subsides almost completely in a short time. This being repeated for several times the patient usually falls into anæmia and emaciation. During the progress of the disease, such symptoms as paleness of visible mucous membrane, œdema at various parts of the body, septicæmic phases and exhaustion appear. Of these the most marked feature of the disease is the disorder of the function of the heart.

General Conditions.—At the first stage of the disease the appetite of the animal is as good as usual, but the patient shows a dull and fatigued appearance. The movement of the limbs is somewhat interfered with. The patient usually slightly responds to whipping and sometimes does not react to the digital pressure at the loin. It is liable to be greatly fatigued with light exercises. As the illness progresses the patient becomes dull and likes to stand still at a dark place such as a corner of a stable, lowering its head. The power of attention is so weakened that the patient does not seem to have any inclination to get rid of flies, even if they swarm about it. With each febrile attack its emaciation and weakness gradually increase, and finally the patient falls to the typical case of pernicious anæmia. As the fatal termination approaches, the animal staggers, and lies down on its side, for its hind quarters do not have strength enough to keep it standing.

Bodily Temperature.—At the outset of the malady the temperature suddenly rises to 39° C. to 40° C., and after remaining so for a day or two (in some cases for many days) it falls to normal very rapidly. Frequency of the febrile attacks is variable. Of 274 cases, 116 had attacks two to nine times a month; in 93 it came after a month; and in 30 after two months. After three months the frequency of recurrence decreases, as is shown in the following six cases. The attack occurred once in one case, twice in three cases, and three times in two cases after more than six months. In one or two cases it came once after seven months. In chronic cases the animal keeps up for some time a subfebrile condition of 38° C. to 39° C.; sometimes such a case changes into an acute form with a sudden elevation of temperature higher than 39° C., or febrile attacks recur periodically for more than a year. Near the final termination the animal usually shows a collapse temperature lower than 36° C.

Visible Mucous Membrane.—The eye-lids and conjunctiva are, at the outset, of a dirty yellowish-red or yellowish-brown colour, slightly swollen, humid, showing a ramiform injection of the blood-vessels. After some time the mucous membrane is gradually discoloured and becomes yellowish-grey or pale or even whitish in the extreme cases; the swelling disappears. The tinge of other mucous membrane alters somewhat similar to that of the conjunctiva.

Petechiæ.—During the febrile attacks petechiæ appear in the conjunctiva, the mucous membrane of the nose, gingiva and other parts, and the mucosa of the rectum, &c. Usually they range from the size of a pin's head to a millet grain. Often, however, they aggregate themselves to form a hæmorrhagic area as large as a finger-ball.

Œdema.—Œdema usually appears at the belly, prepuce, lower portions of the limbs, face masseter region, lips, head, thorax, &c. Its extension varies proportionally with the condition of the malady. As in the case of petechial fever, the facial, laryngeal and tracheal regions are so much swollen that respiration and deglutition are interfered with. In rare cases œdema suddenly vanishes immediately prior to death.

Digestive Tract.—During the febrile attacks the patient's appetite is, more or less, impaired, as is usually the case with other febrile diseases, or is sometimes totally lacking. But no change is found in the digestive tract. Not infrequently a patient in an advanced case continues eating even when it can no longer stand on its feet.

The peristaltic action of the intestine is usually normal, but sometimes it is a little accelerated. The fæces are normal, but near the fatal termination they are softened or sometimes coated with a slimy mucus. By the time this stage is reached the anus is relaxed in many cases and temperature reading is thus rendered impossible.

Spleen.—The swelling of the spleen is a constant phenomenon during the febrile attacks, as can be detected by rectal examination. In chronic cases or inter-febrile periods the swelling varies in degree. In the cases of extreme anæmia the spleen is swollen very little or not at all.

(6) Course and Prognosis.

The disease can conveniently be divided into the acute, the subacute, and the chronic, but no sharp line of demarcation can be drawn between them. In the acute form high temperature remains for some time. After from a few days to two weeks from the beginning of the disease, the final termination comes always by the appearance of symptoms of septicæmia.

Those animals which pass through the first febrile attack may become better for a time, but a very small proportion of the

patients completely recover. In many cases another febrile exacerbation returns after two or three weeks, being accompanied by worse symptoms than the first. They then change into acute cases, and sometimes may remain for nearly a month. In chronic cases the disease continues from a few months to over a year, during which time the condition of the disease fluctuates with the recurrence of febrile attacks, or it changes into an acute type, and the final issue comes from anæmia and emaciation.

Prognosis of the disease is generally doubtful, and all the horses that contract the worst type of the disease are sure to die with the frequent recurrence of febrile attacks. Horses which have apparently recovered are liable to become ill again by certain insanitary conditions, especially by unfavourable climate or hard labour. Such patients usually die of another attack after a few months or in the following year. But in case the course of the disease is good, the patient acquires immunity and febrile fits come no longer. Not only do such patients look healthy (despite the fact that they are still the virus-carriers), but they can stand any ordinary labour.

(7) Therapy.

In the first place, we made a series of experiments with a number of medicines that might possibly destroy the virus. However, none of them being found to be of any promise, we were obliged to be content, for the time being, with the hope of increasing the resistance of the patient against the disease. We experimented with all the available forms of therapeutics, taking the specific nature of the disease into consideration, that is, infectiousness, severe anæmia, recurrence of high fever, and the slow and prolonged course of the disease itself. The results were all unsatisfactory.

Care of the patient and allopathy:—

(1) Exercise, labour and exposure, *e.g.*, to extreme heat and cold, winds, snow and rain are apt to bring about exacerbation. The guard against these untoward conditions results in the abatement of febrile attacks and improves the course of the disease.

(2) Cardiacs, tonics, and digestives are effective to abate the symptoms.

(3) Nutritious and easily digestible food improves the con-

dition of the patient and consequently tend to increase the resistance of the constitution.

(8) Immunization.

It has been observed that the animal that survived the disease no longer contracts it even if a large quantity of the virulent blood is inoculated. Thus a certain degree of immunity seems unquestionably to be acquired, but whether or no the serum of these immunized horses possesses any therapeutic or preventive properties must be decided by a systematic study. Accordingly, seven recovered horses were selected in which increasing inoculations were made with the following results:—

We injected 2 c.c. of the serum of an affected horse, which was gradually increased up to 2,000-4,000 c.c. with a pause of three to six days. Only three of the seven horses were made perfectly immune, while two died of infectious anæmia during the course of the treatment, and with the remaining two it was necessary to stop the treatment because of the swellings and hyperæsthesia at the site of inoculation.

(9) Preventive Inoculation and Disinfection.

From what has already been described, it is certain that the horse may be made immune against infectious anæmia, and we made a number of experiments to effect the preventive inoculation. The results of all these experiments, however, turned out to be negative.

Departmental Ordinances.

Draft of Regulations for the Prevention of Infectious Anæmia among Horses.

Art. 1.—The pasturing district that is brought under the control of the Regulations for the Prevention of Infectious Anæmia shall be called "prevention district."

Art. 2.—Local governors shall determine the prevention districts, and give notice thereof throughout the districts under their respective jurisdictions, and shall report thereon to the Minister of Agriculture and Commerce and inform the local governors of the neighbouring prefectures thereof.

Art. 3.—Police officers, mayors, town headmen and village headmen shall report cases of infectious anæmia to the local

governors, when they receive reports from the owners of the diseased animals.

NOTE.—In the city of Tokyo, Kyoto, Osaka and Nagoya the urban district headmen shall perform the duty imposed upon the town headmen or village headmen. This will be the same throughout the regulations.

Art. 4.—Horse-owners or those who have the charge of horses shall immediately report the death and slaughter of horses affected with infectious anæmia to police officers, mayors, town headmen or village headmen.

Police officers, mayors, town headmen or village headmen, who receive such support shall report to the local governor.

Art. 5.—The police officers, mayors, town headmen or village headmen in the same prevention districts shall inform with one another the fact that they have received such reports according to Arts. 3 and 4.

Art. 6.—When there are indications of the spread of infectious anæmia among horses in any prefecture, the local governor shall give notice of the provisions under Arts. 3 and 4 throughout the district under his jurisdiction and at the same time give a report thereof to both the Minister of Agriculture and Commerce and to the local governors of the neighbouring prefectures.

Art. 7.—Local governors shall station inspectors at several places in the prevention district and make them carry out physical examinations on all the horses.

They shall appoint these inspectors from officers belonging to them, city, town, and village officials and veterinarians.

Art. 8.—Physical examinations shall be carried on at least once a week during the epizootic season and once a month during the rest of the year.

Local governors may increase or decrease the number of inspectors according to the condition of the outbreak.

Art. 9.—Police officers, mayors, town headmen and village headmen who have received reports or found out by inquiry a case of infectious anæmia, shall immediately inform the inspectors thereof, who shall make examination at the place of occurrence.

Art. 10.—In case inspectors find out patients or suspicious cases, they shall make the horse owners, or those who have charge of the horses, isolate the patients, or kill them if necessary.

Art. 11.—If the affected horses that were isolated according to Art. 10 recover, the exercise test shall carefully be performed with them. If perfectly normal, they may be set free.

Art. 12.—In case there are indications of the epizootic within the prevention district, the local governor may prohibit the removal of horses in a certain region or the introduction of affected horses or suspicious cases.

Local governors shall give notification throughout the district under their jurisdiction, report to the Minister of Agriculture and Commerce, and inform local governors of the neighbouring prefectures about the district set apart according to Art. 12.

Art. 13.—Local governors shall investigate the conditions of the outbreak of infectious anæmia and shall report the results once a month to the Minister of Agriculture and Commerce according to the accompanying form (the form is omitted).

Art. 14.—Local governors shall notify the people throughout the district under their jurisdiction, report to the Minister of Agriculture and Commerce, and inform local governors of the neighbouring prefectures of the discontinuance of the enforcement of Arts. 2 and 12.

DEATH OF SIR W. GILBEY.

A LIFE full of accomplishment has ended by the death of Sir Walter Gilbey at the age of 83. From a subordinate in an estate agent's office and a clerk in the Army Pay Department in the Crimea, he rose to be the head of a great wine and spirit business and a unique authority on horse matters. He founded the Old English Cart Horse Society in 1877. He was one of the leading spirits in the formation of the Hackney Horse Society. He initiated the movement that led to the formation of the Royal Commission on Horse Breeding. He established the Whit Monday Cart Horse Parade in 1886. The late King Edward in 1891 attended at a meeting held in his honour and presented him with his portrait by Orchardson. He was granted a title in 1893. No man has done more for stockbreeding than Sir Walter; few men have written more about horse-breeding and no man was more capable of giving sound advice on the subject. His life is a record of useful work well done, and agriculture and horse-breeding lose a true friend by his death. He was of a cheery and genial disposition and ever ready to help and encourage those working in the same fields as himself. He is succeeded by Henry Walter Gilbey, born in 1859.

Clinical Articles.

STRANGULATED SCROTAL HERNIA.

By F. MORTON WALLIS, M.R.C.V.S.

Halstead, Essex.

Some time since I received an urgent call to attend a yearling cart colt which was described as badly "griped." On arrival I found the animal sweating profusely, and showing all the usual symptoms of great pain. On examination I found strangulated scrotal hernia the evident cause. The scrotum was full and hard, and on passing my hand into the rectum I could feel the continuance of the bowel descending into the scrotum also full and tense. The case being very serious and urgent, I at once adopted a line of treatment *which has yielded me success before*. I injected hypodermically 1 gr. each of physostigmin salicylate and pilocarpine hydrochloride. On release the colt at once lay down, turned on its back, which I took advantage of to secure his legs and keep him in that position for about three-quarters of an hour, with a bag of chaff either side to assist.

Having emptied the bowel as far as possible on first examination, in about twenty minutes after the injection I passed one hand up the rectum and placed the other on the scrotum, and by gentle manipulation, aided by the action of drugs named above (and without which, in my opinion, my manipulations would have been absolutely useless), I had the parts reduced and the colt up under the hour.

An anodyne draught, quiet and careful feeding completed the cure, and three weeks after I castrated him by the usual covered operation, and he is now a well-grown and promising colt.

I do not claim that there is anything unique in my treatment, as, of course, others may have done the same, but I have never heard of its adoption, and knowing how many veterinary surgeons fear to use these drugs in much less complicated cases, "I hae ma doots." I am satisfied that the want of confidence in and fear of these drugs is mainly caused by their not being adopted early enough in the cases. After large use of these drugs for many years now, I can honestly say I have never had the least reason to suspect them as being the cause of any untoward

circumstances in any cases I may have lost where they have been used.

They are invaluable in the *earliest* stages of impaction of the bowel—impaction with tympany (here assisted by puncture of bowel)—and cases of choking. I never give more than 1½ gr. of each, and not often under 1 gr., but am most particular to buy only the best drugs.

One great advantage is that in some rare cases where you do not get the desired result, you can always follow on with a full dose of aloes without any fear whatever of the result.

INTESTINAL OAT-HAIR DUNG-BALL CALCULUS IN A MARE.

By HENRY B. EVE, M.R.C.V.S.
Folkestone.

Subject.—A heavy vanner, the property of the South Eastern and Chatham Railway Company, Hythe.

History.—The animal concerned had only been doing its usual work, and appeared all right over-night when fed, and did its usual round next morning, when carman noticed it amiss, and brought it home, and I was 'phoned to attend on October 19.

Symptoms.—On arrival I found the mare showing symptoms of engorgement of the stomach, with gastric tympany, intermittent colicky pains, pawing with fore-feet, countenance haggard, eye distressed, back arched, belly distended, respiration hurried. The animal frequently had a tendency to rest its hind quarters against the side of the stall, and bowels were severely constipated, and habitually so. When removed to a loose-box mare stuck its nose in a corner for a time, and frequently backed into a corner, indicating (stoppage of the bowels) double colon impaction, and at times sat on its haunches like a dog and raised itself from the ground like a cow with milk fever endeavouring to get up, which position appeared to give relief for a time. Accelerated pulse and temperature elevated. Straining as if wanting to stale continually.

Diagnosis.—Intestinal obstruction, probably a twist or calculus.

Prognosis.—Unfavourable.

Treatment.—Gave an oleaginous purgative and sedative

draught, and adopted usual treatment, had animal walked about. (Noon) internally applied counter-irritant to abdomen. Administered morphia and atropine, hypo. (6 p.m.) revisited, gave hypo., eserine and pilocarpine and stimulants. (11 p.m.) hypo. strychnine, no result.

Next day gave arecoline, but with no satisfactory effect, only produced salivation, and no fæces were passed, but hastened death, which occurred on the 21st.

Oat-hair Concretion (Dung-ball).

Remarks.—As anticipated, the mare died, and, unfortunately, I was unable to be present at *post-mortem*, but the knacker man kindly informed me that the "guts" were twisted, and in addition that they found a huge dung-ball calculus, which he kindly sent by carrier for me to see. It was about the size of a large coconut and weighed 3 lb. 15 oz. (see illustration).

P.S.—This is the second case I have encountered recently of impaction due to the same cause. The first one I came across when meeting Mr. W. W. Gulleford, M.R.C.V.S., Lympne, Hythe, in consultation. He made the *post-mortem* and verified diagnosis, which defied all treatment.

TWO CASES OF TETANUS TREATED WITH ANTI-TETANIC SERUM (PARKE, DAVIS & CO.).

By W. WATERS, M.R.C.V.S.
Blofield, near Norwich.

Case I.

Subject.—A six-year-old gelding, the property of a small coal merchant.

History and Treatment.—On June 24, 1913, the said horse was led to my premises (a distance of four miles) for me to see owing to his being stiff and unable to eat. Upon examination I found I had a typical case of tetanus to deal with, the seat of entry for the bacilli being a large artery on his sheath. I sent the horse off home again at once and had him put into a darkened, roomy box and kept quiet.

I managed with difficulty to give him a physic ball, then cauterized the artery on its raw places, and finally gave him a dose of anti-tetanic serum. On the third and sixth day further doses of serum were given. From the third day of treatment the patient progressed steadily, making an uneventful recovery, and going back to work again in three weeks.

Case II.

Subject.—A valuable six-year-old cart mare, the property of a farmer.

History and Treatment.—I was sent for to see this mare on January 23, 1914. I found that she had suffered from a pricked foot three weeks previously, which had been attended to by the blacksmith.

Two days before I saw her she was noticed to be getting very stiff all over and disinclined to feed, so owner sent her to work, only to find that the more exercise she had the worse she became.

Upon examination there was no difficulty in diagnosing a very severe attack of tetanus, the jaws being locked so much that it was quite impossible to get one's hand into her mouth. Also, when we tried to move her into a more roomy and isolated box, we had the greatest of difficulty to keep her from falling down. A dose of serum was administered at once, and as case was very far advanced the dose was repeated on the second, fourth, sixth, and eighth day. She was just able to sip water

and very sloppy mashes, so salines were given by this means to take the place of a dose of physic.

Progress after the first few days was slow but steady, and she made a perfect recovery in three weeks from date of first visit.

Remarks.—As these are the only two cases which I have treated by the serum method I do not expect to be always so successful, but I think it is always worth a trial, provided that the animal is of sufficient value to pay for the expense.

FRACTURE OF THE SPINAL COLUMN IN A HORSE WHILE RESISTING AN OPERATION.

By M. ELOIRE,

Of the Alforts Veterinary School in France.

A GOOD-SIZED pony, about 6 or 7 years old, of a very nervous temperament, was with difficulty placed under restraint preparatory to a dental operation.

The animal struggled and started, in spite of a chain round its neck, a lever to prevent backing extended from the longitudinal bars of the apparatus, and a "twitch" on the upper lip, which was held up by an assistant.

The right-hand molars having been fairly well levelled and rasped down the left side was about to be begun when the animal fixed his hind legs and gathered himself up for a great effort, pulling violently from the collar-bone against the neck chain.

Situated as I was at the pony's head, I took the effort that he made to be an expulsive action of the rectum, and fearing an inversion of that organ I had the restraining head and tail ropes unfastened.

The animal collapsed on to its haunches with its head hanging over an iron crossbar situated between the two front uprights of the apparatus.

On being extricated the animal remained on the ground in the position of a squatting dog. It finally fell over on its flank in a futile attempt to recover its feet. This proved to be a physical impossibility. Fruitless exertions caused the tail to be carried horizontally and to be jerked up and down by little convulsive contractions.

With the help of bars passed underneath we endeavoured to

lift the animal on to its feet, but while the front feet could be maintained in a standing position, the hind quarters remained inert with crossed legs tailor-fashion. There was no doubt about what had happened—in an instant, under our very eyes the vertebral column had been dislocated in the frantic muscular effort made by the animal to free himself from constraint. This had occurred at the moment that it had gathered itself up into the curved, buck-jumping attitude.

The horse was slaughtered for food. On examination the spinal cord was found to be crushed into the medullary channel.

This kind of accident, which has been observed from time to time in the case of a cast animal, has been attributed by practitioners to the efforts made by the animal at the moment of its fall upon the ground and not to the animal's contractions in endeavouring to free itself while being cast.

The present case is perhaps unique, being the rupture of the vertebral column in a standing horse where there had been no fall; therefore the accident which we had witnessed was obviously due to excessive muscular contraction alone.

This experience teaches us that a horse while struggling under any sort of operation—whether the animal be standing or cast—should, above all, be prevented from assuming the curved position which has been described above. Such prevention can be effected in the case of a standing horse by keeping the head very high up, and in the case of a cast horse by pressing the head back on the neck as far as possible. In doing this the practitioner's assistant should place his hand under the animal's lower jaws and actually lift the head, instead of depending on the drawing-up action of halter or bridle.

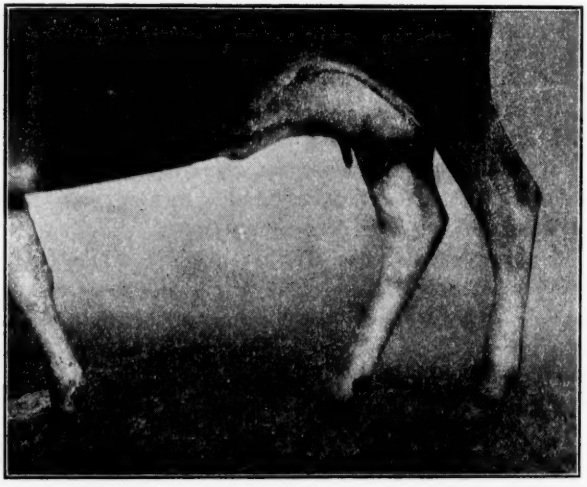
AN UNUSUAL SKIN ERUPTION AFFECTING THE UDDER.

By HENRY TAYLOR, F.R.C.V.S.
Haywards Heath.

The accompanying photograph illustrates a very curious eruption on the skin of the udder, a condition which I have not met with before. The most common skin eruptions in this region are cowpox, a pustular affection in which small pustules about the size of a lentil form, the skin destruction not extending deeper than the stratum

lucidum ; and, lastly, a carbuncular eruption, which finally results in the formation of punched-out holes in the skin extending down to the subcutaneous tissue. The affection in question was quite different from either of the above.

The animal was a young Jersey cow which had recently calved, aged 3 years. The lesions on the skin consisted of numbers of reddish-brown scabs, in circumference about the size of a threepenny bit, but raised above the surrounding skin to a height of about ¼ in. The scabs were found both on the teats and on the udder itself, and there was apparently no difference in the size and shape in



Eruption on the Udder and Teats.

either case. The scabs could be fairly easily removed from their attachments, leaving in such an event a red excoriated base which did not seem to extend to any depth into the skin. The affection seemed to begin as a reddish papular eruption as far as one could judge, the apex of the papule quickly changing into the above-mentioned scabs. There was a good deal of itching, but not much soreness, the animal frequently licking the udder to allay the itching. This resulted in the disease being transferred to the nose, but here no scabs formed, the chief noticeable lesions being light-coloured areas about the circumference of the scabs on a dark-coloured background.

The treatment consisted in washing the udder with antiseptic

lotions followed by the application of an ointment containing boracic acid and eucalyptus, and in a short time the places left by the detached scabs soon healed, and as no fresh crops appeared the cure was soon complete.

The spots are rather obscure in the photo.

[An aphthous-like disease of cattle has been noticed on the Continent, where yellowish-red nodules appear on the muzzle and exceptionally on the nasal mucosa, and at the same time nodules the size of a lentil with several vesicles and subsequent crust formation appear on the udder and teats.—G. M.]

Feline Clinical.

PARALYSIS IN A CAT—RESULT OF FALLING FROM A GREAT HEIGHT.

By F. C. MAHON, M.R.C.V.S.
Chiswick, W.

In a long and varied experience now close upon thirty years, among both the canine and feline species, I have encountered a few remarkable cases, none of which, however, can be placed in the same category as the one I am about to relate.

Breed, Siamese cat, age about 18 months. Last January she fell inadvertently from a window whose height from the ground was approximately 70 ft. Beyond a few minor injuries to the mouth, no particular feature bordering on fracture of any portion of the appendicular skeleton, or displacement of the vertebral column, was discoverable. Concussion of the brain and spinal cord were marked, the patient lying inert for about three days, when she recovered all natural movements, regained her usual appetite, comported herself in a natural manner in all ways. She gave birth some few months ago, and the act of parturition was accomplished in a perfectly easy manner.

Whilst at play with one of her kittens, she was seen to disappear into space, and was picked up from the concreted area surrounding the flat. I saw her within an hour of the occurrence, and after a careful examination was sceptical as to her ultimate recovery. Being a prize-winner, and above all a gentle patient, I persevered with treatment. The upper lip being injured, and several incisor teeth of the upper jaw forcibly broken away, I

disinfected the mouth with a weak solution of chinisol, followed by adrenalin 1 in 1,000. I detected no fracture, found no hæmorrhage from the bowels or vagina, detected no pain of any distinctive character, more marked in one region than another, but found the hind quarters devoid of use, and insensitive from the lumbar region posteriorly to tip of tail insensitive to pin-pricking.

Locally *pro tem.* I used belladonna liniment along the spine, warm water flannel compresses, and at intervals directed a few drops of mustard oil to be gently rubbed along the spine. Gave 5 minim doses of "Glonoin" (homœopathic) with an eggspoonful of brandy every two hours. This treatment I continued for several days. Bovril, beaten egg, with a few drops of brandy, were given on the second and successive days, up to the ninth following the accident.

Contemporary with this treatment I gave glycerine injections twice daily. Meanwhile as prostration persisted I prescribed enules of meat. On the twelfth day ordinary appetite returned, with slight use of the right hind leg, especially from the hock upwards. That of the left hind leg remained absent up to the sixteenth day, when the patient commenced to use it slightly.

From this date I daily applied, after massage, friction of loins, quarters, and along spine a weak ointment of capsicum. My patient is, on the twentieth day after the fall, able to move about in comfort, although there is a slight appreciable dragging of the left leg, and the toe of left foot occasionally is bent backwards.

On the eighth and up to the fifteenth day superseding the fall, I gave intramuscular injections of strychnia (5 minims) daily, and certainly with good results. From the fifteenth to twenty-second I withheld same.

I consider the case unique in many respects.

Should I unfortunately encounter any cases of similar character, I shall try hemisine-episine-adrenalin, the active principle of the suprarenal gland—its action on the circulatory system is to cause acceleration of the heart-beat, and powerful constriction of the smaller arteries. I pin great faith to this agent, which I have used under different names, according to the firm who supply it.

Reviews.

Meat and Food Inspectors' Examinations. Model Answers to Questions set by the Royal Sanitary Institute and other Examining Bodies. Compiled by G. T. Billing, Meat Inspector, Metropolitan Borough of Finsbury, and A. H. Walker, Sanitary Inspector, Metropolitan Borough of St. Pancras. Second Edition. Pp. xii + 180. The Sanitary Publishing Company, Ltd., 55-56, Chancery Lane, W.C. 1914.

This work is intended as a guide for candidates presenting themselves for the Meat and Food Inspectors' Examinations held by the Royal Sanitary Institute. There are 165 model answers to questions on many and varied subjects that have been set at examinations held at one time or the other. It is a useful book of its class, and as far as stock questions and answers on any given subject can indicate a candidate's knowledge, no doubt it will be helpful to students, and possibly also to some examiners.

We note that the question as to the sanitary arrangements of a cowshed dates back to 1909. We fancy some more recent data might be given in the year 1914 as answers to this question. The allocation of suitable floor space for cows is in our opinion perhaps the most important matter in connection with cowshed sanitation nowadays.

Specimens of *viva voce* questions and answers are included in the little volume, and at the end, in the Appendices, there is given a summary of butchers' joints, their composition and approximate weight, and plans of the sides of carcases with the various cuts marked out.

The book may be described as a very useful one for veterinary surgeons, in which desirable knowledge in many points of meat and food inspection is given in condensed form. As a handbook for candidates for the R.S.I. certificates it is almost indispensable. It is well bound and well printed.

G. M.

Parasites et Maladies parasitaires du Chien et du Chat. By L. G. Neumann, Professeur à l'Ecole Nationale Vétérinaire de Toulouse. 15 figs. in the text. Publishers, Asselin and Houzeau, Place de l'Ecole-de-Médecine, Paris. 1914.

The great number of animal or vegetable species that can instal themselves in the organism of the dog, and frequently affect the cat, renders a book solely devoted to parasitism as it concerns them particularly appropriate and acceptable. The author in 340 pages of letterpress has pretty well put everything of importance that is known in France and foreign countries of this special domain before his readers. He has not neglected to dwell on that aspect of the subject which deals with the conveyance of canine and feline parasitism to human beings and herbivora. Inasmuch as there are apparently still men who pose as judges and assert that sarcoptic mange of the dog is not

communicable to man, it is interesting to note that Monsieur Neumann quotes about a dozen authorities who have seen many cases of human mange caught from the dog, and the writer, having suffered himself from the complaint, knows that the communication of the malady from the dog to man is quite possible. The fact that sarcoptic mange can also be transmitted from the dog to the horse should not be lost sight of. The book deals fully with both internal and external parasites. The little volume should be very useful to veterinary surgeons, naturalists, and dog and cat breeders. A few pages at the end of the book are devoted to the parasites of that useful domesticated variety of the polecat called the ferret. We can heartily commend the book to those who wish to specialize in the diagnosis and treatment of parasitism. An English translation of it would doubtless circulate well in this country. We note that the author has also produced a little work in French on "The Parasites and Parasitic Maladies of Domestic Birds." Few books on the Diseases of Birds exist, and any branching out in this field of science indicates desirable progress. G. M.

SPECIAL NOTICE.

We shall shortly publish a Special War Number of particular and permanent interest to the Veterinary Profession. The Editor will be glad to receive, both from Army Veterinary Officers and from Civil Officers attached to the Army Veterinary Service, contributions dealing with the work being done by our profession in connection with the British Expeditionary Force.

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